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(19)(CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Remote Starter, Control and Security System for Vehicles with Internal Combustion Engines

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TITLE: Remote Starter, Control and Security System For Vehicles With Internal Combustion Engines

FIELD OF THE INVENTION

This invention relates to a device for remotely controlling the function of specified systems of a vehicle having an internal combustion engine. In particular, the device allows for remotely controlling a vehicle's starting and ignition systems, and heating and cooling fan systems and also provides a remotely controlled security system for the vehicle.

BACKGROUND OF THE INVENTION

A wide variety of different types and forms of remote starting and control devices have been proposed by others for use in vehicles with internal combustion engines. Such devices have ranged from fixed starters and controls placed within a building or home and hard-wired into a vehicle, to portable radio frequency transmitters that may be used to transmit signals to a receiver placed in the vehicle. While such devices have met with limited success, they also suffer from a number of inherent difficulties. Fixed and hard-wired systems are both expensive and inconvenient to use, whereas newer portable radio frequency transmitters have very limited range and may make a vehicle susceptible to theft. Sophisticated automobile thieves may wander through car parking lots using electronic equipment to "capture" a radio

frequency signal transmitted by a hand held transmitter. When the automobile operator has left the vicinity of the car, that "captured" signal can be repeated thereby allowing for unauthorized entry or starting of the vehicle.

Similarly, a variety of different vehicle security systems have been proposed and developed. Like the newer forms of remote starters, most vehicle security systems operate through the use of a portable radio frequency transmitter. Often such systems also include a manual arming and disarming switch located within the vehicle itself.

Such security systems also suffer from their own inherent and difficulties. Those systems that contain a manual switch within the vehicle enable a thief to enter the vehicle and disarm the system. Other systems that utilize a portable radio frequency transmitter may, like remote starters, enable thieves to "capture" the arming and disarming frequency in order to re-transmit that frequency later to disarm the system. In addition, in most cases an activated alarm results in the sounding of a siren and the flashing of the vehicle's lights, which is only effective if the vehicle is not left in a remote or deserted area.

SUMMARY OF THE INVENTION

Accordingly, in one of its embodiments the prevent invention provides a device for remotely controlling the function of specified systems of a vehicle having an internal combustion engine, the device comprising: (i) a microprocessor control for monitoring and controlling the function and operation of said specified systems of said vehicle; (ii) receiving means to receive a plurality of remotely transmitted command signals; (iii) decoding means to decode and authenticate said received signals and to thereafter deliver said decoded and authenticated signals to said microprocessor control; (iv) a main housing unit for containing said microprocessor control, said receiving means and said decoding means; and, (v) an integrated security system, said security system including alarm means, said alarm means armed and disarmed by said microprocessor control upon receipt of corresponding remotely transmitted command signals; wherein said remotely transmitted command signals are numerical pager signals, said numerical pager signals transmitted by a paging transmission network and activated through the operation of a touch tone telephone hand set, said numerical pager signals received by said receiving means, decoded by said decoder means, and then directed to said microprocessor control to control the functioning of said specified systems of said vehicle.

In a further embodiment, the invention provides a device for remotely controlling the function of specified systems of a vehicle having an internal combustion engine

including means to automatically arm and disarm alarm means when the operator of said vehicle moves a pre-determined distance away from said vehicle.

Further objects and advantages of the invention will become apparent from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings which show the preferred embodiments of the present invention in which:

Figure 1 is a sketch of the remote starter, control and security system according to the preferred embodiment of the present invention; and

Figure 2 is a block diagram showing the various functions, components and operations of the remote starter, control and security system of Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In Figure 1, the remote starter, control and security system according to the present invention is noted generally by the reference numeral 1. Device 1 is comprised generally of a main housing unit 2, a beeper control module 3, a photo sensor 4, a photo transmitter 5, a beeper 6, and a remote relay 7. Main housing unit 2 includes

a series of electrical conductors 8 for connecting the unit to the vehicle's various operating systems and power source. Primary power for device 1 will be drawn from the vehicle's battery 48. However, device 1 also includes a re-chargeable internal battery 35 that will provide power in the event of an interruption in the vehicle's power supply. Battery 35 is automatically re-charged directly from the vehicle so that it will remain in a fully charged state. It will be appreciated that main housing unit 2, beeper control module 3, photo sensor 4 and remote relay 7 will all be physically located and attached to the vehicle whereas photo transmitter 5 and beeper 6 are portable and would normally be carried by the vehicle's operator.

Referring now to Figure 2, a block diagram is provided to show the various functions, structure and operations of device 1. While device 1 is comprised of a number of different and separate components, its principle functions and operations are carried out by a microprocessor control 9. Microprocessor control 9 includes an electrically erasable memory (EEPROM) which will retains data regarding the last commands which have been received. This will ensure that in the event of a power interruption device 1 will be placed back into its same level of operation upon a resumption of the power supply. There are three primary methods to send instruction signals to microprocessor control 9. These three methods are through the use of beeper 6, through the use of photo transmitter 5 or through a remotely generated pager signal.

In the preferred embodiment the primary instructions provided to microprocessor control 9 will be by way of a remotely transmitted pager signal that is received by a receiving means 10 located with main housing unit 2. It is significant to note that, unlike some previous devices, receiving means 10 is not a tone pager. Rather receiving means 10 is an integrated receiver, built directly into main housing unit 2, that is only capable of receiving numerical signals transmitted over a paging network 49. Device 1 does not rely upon the generation or reception of audio pager tones or signals. Receiving means 10 captures pager signals in electronic form and sends them to a decoding means 11. Decoding means 11 decodes the numerical pager signals, authenticates them, and then delivers only the decoded and authenticated signals to microprocessor control 9. It will therefore be appreciated that through operation of a standard touch tone telephone hand set 50, a pager signal may be transmitted by a paging transmission network such that an electronic code entered into a touch tone telephone can be received by receiving means 10. Decoding means 11 is enable to decode the electronic paging signal and deliver that decoded signal to microprocessor control 9 so that the instructions in the paging signal can be carried out, whatever they may be. Only decoded and authenticated signals are sent by decoding means 11 to microprocessor control 9 thereby preventing unauthorized signals from being received and acted upon. Decoding means 11 also preferably contains a signal noise software filter, error protection and a filter for non-digital characters (such as -, *, # etc) to reduce signal error.

As indicated, the pager signals sent and received are numerical signals, as opposed to traditional tone signals. Through the use of numerical signals an unlimited number of instructions or command codes can be delivered to microprocessor control 9 through use of a standard telephone hand set. Whereas previous pager signal operated devices could only receive a single instruction and had limited application, device 1 is capable of receiving and acting upon numerous different signal commands. This represents a significant advancement over the prior art and allows device 1 to control many more vehicle systems and functions than was previously possible.

Accordingly, upon the actuation of a series of keys on a touch tone telephone, a variety of specified systems of the vehicle or its engine can be controlled. By entering a pre-determined sequence of key strokes on a telephone hand set, and by broadcasting the corresponding numerical code over a paging network, an operator is able to remotely start or shut off the engine of his vehicle, control and operate the heating and cooling fan 60 systems of the vehicle, and arm and disarm the security system. For purposes of security and accuracy, the remotely transmitted numerical pager signal will preferably be a digital signal. While the operation and control of these primary systems will be discussed, it will be understood that other vehicle systems could equally be controlled by microprocessor 9.

As discussed, one of the primary applications for device 1 is expected to be the remote starting of a vehicle. To remotely start a vehicle an operator would typically key a pre-determined sequence of digits into a touch tone telephone that has accessed a numerical pager network. Following receipt of a decoded numerical pager signal, microprocessor control 9 will activate the vehicle's ignition system 61. In these regards microprocessor control 9 also includes a timing means 12 to operate the vehicle's starter motor for a pre-determined time interval. In conjunction with timing means 12 is a monitoring means 13 which monitors the engine to determine whether it has been started. On the initial attempt to start the engine, microprocessor control 9 will activate the vehicle's starter motor for approximately 1 second. If at that point monitoring means 13 detects that the engine has started, no further action will be taken. However, if after the 1 second interval monitoring means 13 indicates that the engine has not started, a second starting attempt will take place where the starter motor will be activated for approximately 1 1/2 seconds. Similarly, a third attempt at starting the engine may be necessary where the starter motor is run for about 2 seconds. A fourth, fifth and sixth attempt with a 2 1/2 second starting interval may also be implemented. If the vehicle does not start after the sixth attempt, the system will abort any further attempt to start the engine. Typically, once the vehicle has started microprocessor control 9 will also activate the heating or cooling system by starting the vehicle's electric fan, thereby allowing the vehicle to warm up (if the

heater has been left in the "on" position) or to cool down (provided that the air conditioner was left in the "on" position).

In the preferred embodiment, monitoring means 13 comprises either a means to monitor voltage fluctuations in electrical conductors that are connected to the alternator or tachometer of the engine, or a means to detect the continuous transmission of electrical pulses through the ignition wires of the engine. In some cases both embodiments of monitoring means 13 would be employed, with each serving as a back-up or check for the other.

In the first embodiment of monitoring means 13, microprocessor control 9 is wired directly to the output side of the vehicle's alternator 28 in order to monitor voltage fluctuations produced by the alternator. The fluctuations in voltage coming from the alternator can be monitored and compared against standardized alternator fluctuations that are created by running or operating engine (as opposed to an engine merely to being turned over by a starter motor) to determine whether the engine has in fact been started. Alternately, and particularly for diesel powered vehicles, microprocessor control 9 may be connected to the vehicle's tachometer to monitor voltage fluctuations at the tachometer and thereby determine whether the engine has been started.

In the second embodiment of monitoring means 13, an electrically conductive wire is wrapped around the circumference of one of the ignition wires of the engine to create an electrical coil 25 about the ignition wire. As the ignition system of the engine fires and a high voltage pulse is sent through the ignition wire, a current will be induced into coil 25 surrounding the wire. Microprocessor control 9 is able to monitor that induced current so as to determine the pulse rate of the ignition wire, and hence the firing of the spark plug connected to that wire. In this fashion, microprocessor control 9 is able to determine whether the engine has been started or whether the ignition system is merely firing due to the operation of the starting system.

Typically a remotely started engine will be allowed to operate from 10 to 20 minutes. The precise time of operation is controllable by a technician who initiates a 10 or 20 minute run command when the system is installed. Depending upon the climate and use of the vehicle, a shorter or longer period of time may be necessary in order to sufficiently warm or cool the vehicle after it has been sitting unused for a length of time. Timing means 12 also serves the function of automatically shutting down a remotely started engine a pre-determined time after it has been started, unless the operator uses a telephone to enter an additional command code to reset timing means 12.

As a security feature, if an individual enters the vehicle that has been remotely started a switch 14 that is connected to the vehicle's brake system and wired to microprocessor control 9 will cause the vehicle's engine to shut down if the brake pedal is depressed. In order to by-pass this security system, the operator need only insert the key into the ignition switch and turn the ignition to the "on" position immediately upon entering a remotely started vehicle. In this case device 1 will not activate the starter motor.

As a further safety feature, device 1 includes a hood switch 15 (also wired into microprocessor control 9) which will prevent the engine from being remotely started if the hood is open. This safety feature will help to prevent injury to persons who may be performing maintenance on the vehicle. In addition, microprocessor control 9 will automatically lock the vehicle's doors upon receiving a remote "start" pager command to help prevent unauthorized persons from driving away with the vehicle.

Device 1 can also be used to remotely start a vehicle having a manual transmission. When installed in a vehicle having a manual transmission, device 1 will include a dashboard switch 56 and a parking brake switch 57. Preferably dashboard switch 56 is a push button or spring loaded switch that will assume a non-engaged position when released. To allow a manual transmission vehicle to be remotely started, a series of specific steps must be undertaken by the operator, prior to shutting off the

vehicle's engine, to prepare the vehicle for remote starting. First, the operator must bring the vehicle to a stop. Next, with the engine running, the parking brake must be engaged, thereby also engaging parking brake switch 57. The vehicle's transmission must then be shifted into neutral and the ignition switch turned off while manually holding dashboard switch 56 in its engaged position. That is, dashboard switch 56 must be engaged when the ignition switch is turned off. If parking brake switch 57 and dashboard switch 56 are not engaged while the ignition switch is being turned off, microprocessor control 9 will not permit subsequent remote starting. This forces the operator to perform a series of defined steps so that he consciously is aware that the vehicle is being prepared for remote starting. In addition, parking brake switch 57 will prevent the vehicle from being started without the parking brake engaged. As a further safety feature, a transmission sensor 58 may be used to determine whether the transmission has been placed in neutral. If transmission sensor 58 indicates that the transmission is not in neutral, microprocessor control 9 will not allow for subsequent remote starting. This feature will prevent remote starting when the vehicle is in gear.

Aside from remotely starting, heating and cooling a vehicle, the second primary function of device 1 is as an alarm or security system for the vehicle. Microprocessor control 9 is also central and vital to the operation of the vehicle security system. The security system includes alarm means 16 which is also

initiatable through receipt of a numerical pager signal by receiving means 10. Similar to the manner in which the remote starter is activated, an operator can arm or disarm the security system by merely entering a pre-determined code through a touch tone telephone system which has accessed a numerical paging network. The transmitted pager signal is received by receiving means 10 and decoded by decoding means 11 to provide the appropriate instructions to microprocessor control 9. Upon receipt of the proper code, microprocessor 9 will energize or de-energize the security system and also automatically lock or unlock the electric locks 27 of the vehicle. In the preferred embodiment alarm means 16 includes a siren 17 and a means 18 to activate the headlights 63 and flashers 64 of the vehicle when the alarm has been activated. To prevent de-activation by a thief, means 18 is an integral part of microprocessor control 9 and wired into the vehicle's lighting system such that when the vehicle's headlights and flashers have been activated by means 18, they cannot be turned off by the vehicle's lighting system switches. They can only be deactivated by turning off the alarm.

Alarm means 16 also preferably includes a visual indicator such as a flashing light emitting diode 65 that provides a means to quickly and easily determine whether the system has been armed. Typically the light emitting diode would be positioned on the dashboard of the vehicle near the front windshield to make it easily visible. The diode can be wired to either remain on constantly or to flash when the security

system has been armed, thereby providing a visual indicator showing the status of the security system.

As for the remainder of the security system, various sensors are utilized that are not unlike those used in other alarm systems. For example, a door sensor 19, a vibration or shock sensor 20, and a glass sensor 21 would typically be installed in the vehicle and wired into microprocessor control 9. If the vehicle is then struck by another vehicle, lifted for towing, or if the integrity of the doors or windows is violated when the security system has been armed, siren 17 will sound and means 18 will activate the vehicle's headlights and flashers to attract attention. In addition, a hood sensor 22 and a trunk sensor 23 may also be incorporated into the security system in order to initiate an alarm in the event of unauthorized entry into either the hood or trunk of the vehicle.

Yet a further aspect of the security system of device 1 is useful in cases where the vehicle has been stolen. In such instances the vehicle owner can enter a pre-determined code, by way of a touch tone telephone, into a numerical paging network instructing microprocessor control 9 to initiate an alarm. When the alarm is initiated, siren 17 is activated as is means 18 causing the vehicle's headlights and flashers to be turned on. Preferably siren 17 will operate at a sound level of approximately 90 to 100 decibels making it practically impossible to remain within the vehicle when

the siren is in operation. In this fashion a thief can essentially be driven out of the vehicle through remote activation of the siren. The owner can therefore effectively make the vehicle undriveable causing the thief to abandon the vehicle along the side of the road. At that point the alarm and flashing lights will draw attention, assisting in the quick recovery of the stolen vehicle.

In addition, while sending the pager code instructing microprocessor 9 to activate the siren, the vehicle owner also has the option of deactivating one of the major operational systems of the vehicle's engine. For example, the ignition system or the fuel pump 24 can be shut down to cause the engine to stall, where local laws and traffic regulations allow. Otherwise, when a thief turns off the ignition switch with hopes of disabling siren 17, microprocessor 9 will thereafter prevent any re-starting of the vehicle until the alarm has been deactivated through the proper pager command. Microprocessor 9 prevents re-starting by electrically isolating the starter, ignition system and fuel pump. In an alternate embodiment, a pager code can be sent to cause microprocessor control 9 to shut down the vehicle's engine when the speedometer drops to zero, signifying that the car has stopped. A speedometer monitor is utilized to determine the status of the speedometer in this embodiment.

The ability of microprocessor control 9 to respond to numerical paging signals transmitted over a paging network can also be used to activate the vehicle's door

locks. Door locks 27 are preferably wired into microprocessor control 9 allowing the microprocessor to control operation of the locks independently from the alarm system. Where an operator leaves a vehicle and realizes at a later time that he or she has forgotten to lock the vehicle's doors (or where the operator wants to ensure that the doors are locked) the appropriate signal can be sent over a paging network to instruct microprocessor control 9 to lock the vehicle's door locks 27. In the event that an operator locks his or her keys inside a vehicle, door locks 27 can be unlocked simply by entering the correct code into a touch tone telephone that has accessed a numerical pager network. The properly entered code will instruct microprocessor control 9 to unlock door locks 27. Further, if the operator has lost the keys to the vehicle, entering the appropriate code over a pager network will allow the operator to both unlock the doors and remotely start the vehicle's engine.

Finally, a further feature of device 1 that can be accessed through a standard touch tone telephone is the operation of the vehicle's headlights, flashers and interior light 66. Again through entering the appropriate code through a touch tone telephone, a numerical pager signal can be transmitted that will instruct microprocessor control 9 to turn on (or turn off as the case my be) a vehicle's headlights, flashers or interior lights. This feature can be useful in the event that any of those lighting systems have been left on inadvertently. This can also be helpful to locate a vehicle in a large parking lot, and can be of assistance for personal security.

Since all operating functions of device 1 can be performed through use of a touch tone telephone, it will be appreciated that an operator can also provide the appropriate instructions to microprocessor control 9 through the use of a mobile or cellular telephone. For example, when approaching a vehicle late at night, an operator can dial the appropriate code into his or her cellular telephone and cause the vehicle headlights and/or interior lights to be turned on.

Accordingly, through entering the appropriate codes into a numerical pager network, the vehicle operator can access a wide variety of specified systems and control the function of those systems. The operation of device 1 can be accomplished easily and simply through any standard telephone, including a mobile or cellular telephone. Furthermore, due to the improved transmission systems available for paging networks today, the range over which instructions can be sent to microprocessor control 9 is significantly larger than for currently produced hand held controls or transmitters. Pager signals are also omni-directional and do not need to be "aimed" at the vehicle as in the case of many pre-existing radio frequency or light transmitting devices. Since the numerical pager signal is received by receiving means 10, decoded by decoding means 11, and directed to microprocessor control 9 in an electronic format, there is no possibility of the system being susceptible to interference, such as may occur with existing security systems that utilize tone pager signals in an audio format.

As eluded to previously, in a situation where the vehicle owner parks the vehicle and arms alarm means 16, microprocessor control 9 will electrically isolate the vehicle's starter motor, ignition system and fuel pump. When the security system is armed the vehicle cannot be started since the starter motor, ignition system and electronic fuel pump will be isolated from the vehicle's power source. Furthermore, since there are no manual controls within the vehicle for operating device 1, a potential thief cannot easily disable device 1. The only practical way to disable device 1 is to physically remove it or disconnect it from the vehicle. To combat that situation, and as a further level of security, device 1 also includes an external remote relay means 7. Relay 7 is located at some position within the vehicle remote from device 1 and serves as a secondary back-up means of protection in the event that a thief were to break into the vehicle and remove or disable microprocessor control 9. Relay 7 is controlled solely by a radio frequency transmission produced by a radio frequency transmitter 26 connected to microprocessor control 9. There are no wires connecting relay 7 to main housing unit 2. Relay 7 is, however, wired to the vehicle fuel pump and/or ignition system. In the event that microprocessor controller 9 is removed or disabled, relay 7 will no longer be controlled by radio frequency transmitter 26, resulting in relay 7 becoming "open" thereby disabling of the vehicle's fuel pump and/or ignition system. It will thus be appreciated that relay 7 adds a further level of security to the vehicle beyond the numerous levels controlled directly by microprocessor control 9. As relay 7 is not wired directly to microprocessor 9, it can

be located practically anywhere within the vehicle making it extremely difficult and time consuming for a thief to locate. Relay 7 can also be incorporated into other structures of the vehicle or disguised as some other part to make it even more difficult to detect or locate.

While in the preferred embodiment many of the vehicle's systems are controlled by means of a numerical pager signal, as indicated, device 1 also includes a photo transmitter 5 and a beeper 6. Photo transmitter 5 and beeper 6 provide additional means to present commands to microprocessor control 9. Dealing first with photo transmitter 5, in the preferred embodiment transmitter 5 is a small hand held transmitter that would typically be clipped onto a key chain. Photo transmitter 5 is battery powered and contains two small buttons 46 and 47 that generate a coded infra-red light signal when depressed. The transmitter is used solely to arm and disarm the security system. Operating in conjunction with photo transmitter 5 is a photo sensor 4 that is typically positioned on the vehicle's dashboard. Photo sensor 4 is preferably a photo diode or photo transistor that receives the coded infra-red light signals sent from photo transmitter 5. Photo transmitter 4 is connected to microprocessor control 9 such that commands received by sensor 4 can be directed to the microprocessor so they may be carried out. The buttons 46 and 47 are configured such that depressing one of them transmits a "system arm" command while depressing the other transmits a "system disarm" command. Accordingly,

through pointing photo transmitter 5 toward photo sensor 4, the vehicle's operator will thus be able to either arm or disarm the security system. When the security system is armed in this manner door locks 27 will also be activated to lock the car, following a one minute delay.

Photo sensor 4 also serves the additional function of providing a means to remotely re-program microprocessor control 9. Through use of a system programmer 67 (shown in ghost outline in Figure 2), a qualified installation technician will be able to send coded infra-red light signals to photo sensor 4, thereby providing new or varied programming to microprocessor 9. In the event that the vehicle owner looses photo transmitter 5, a technician can also provide a replacement transmitter and re-program device 1 to recognize that replacement transmitter without having to physically access main housing unit 2. In a further embodiment, microprocessor control 9 may be re-programmed through the use of a portable or lap-top computer 51 that may be connected to microprocessor control 9 by means of an input jack 52.

The third method by which an operator may provide instructions to microprocessor control 9 is by way of beeper 6. Beeper 6 is preferably in the form of a small, generally rectangular shaped, device that is similar in size to a pager. Typically beeper 6 would be carried by the vehicle operator in a pocket or worn on a belt. Beeper 6 is powered by an internal battery 41 which may be a standard alkaline

battery or may be of the re-chargeable type. Working in conjunction with beeper 6 is a beeper control module 3 situated within main housing unit 2 and connected to microprocessor control 9. Beeper 6 provides a means to automatically arm and disarm alarm means 16, and also provides an interactive indication or confirmation means to notify the operator of the receipt of certain command codes by microprocessor control 9. Beeper 6 will also notify the operator in the event that the vehicle's alarm has been set off. The function and operation of beeper 6 and beeper control module 3 will now be explained.

Beeper control module 3 contains a radio frequency signal transmitter 33 that transmits a radio frequency signal from between approximately 27 MHz and 900 MHz. This signal can be received within a practical operation range of about 1 kilometre by a radio frequency receiver 36 contained within beeper 6. When the vehicle's security system has been armed, radio frequency transmitter 33 sends out a first or "system armed" signal that is captured by radio frequency receiver 36 causing beeper 6 to activate a tone generator 40 that produces a short single tone or "beep" to acknowledge that the security system has been armed. When the vehicle security system is deactivated, a second or "system disarmed" signal is generated by transmitter 33 and picked up by receiver 36. Receiver 36 then causes tone generator 40 to produce a series of 2 short tones or beeps acknowledge that the system has been disarmed. A third, or "system alarm", signal is generated by radio frequency

transmitter 33 in the event that alarm means 16 is activated. In an alarm situation, transmitter 33 generates a continuous signal that causes tone generator 40 to produce a continuous tone or beep, thereby notifying the vehicle operator that the alarm has been activated and that the status of the vehicle should be checked. Further signals can also be generated to indicate other command activations.

This continuous transmission produced by radio frequency transmitter 33 can also be received by police or security agencies in order to notify them that a vehicle is in the process of being stolen. In the preferred embodiment, the "system alarm" signal generated by radio frequency signal transmitter 33 is coded such that it is possible to recognize the unit identification code number of the particular device 1 that is transmitting the signal. This allows for the correlation of the unit identification code number with the make, model, colour and owner of the vehicle for which the alarm has been activated. Receivers and decoders placed in police or security vehicles are then able to receive the signal generated by transmitter 33 and identify the particular vehicle from which the signal is emanating. With the continuous transmission of the signal during an alarm state, police or security personnel can proceed toward the vehicle by driving in a direction wherein the signal strength increases. In other cases, where multiple police or security personnel are involved, triangulation methods may be used to located the vehicle. To stop the continuous tone generated by beeper 6

in an alarm situation, the operator can disconnect battery 41 from the tone generator through operation of a switch 42.

In a further embodiment of beeper 6 a liquid crystal display 43 is provided that, in conjunction with a decoder, can provide a visual display corresponding to the radio frequency transmissions picked up by receiver 36. Signals generated from transmitter 33 can thus be decoded and visually depicted on the LCD display to identify the status of various vehicle systems. For example, liquid crystal display 43 on beeper 6 could indicate whether the vehicle engine is running, whether the heating or cooling system is on, whether the doors are locked, whether the lights are on, etc. In yet a further embodiment, tone generator 40 could be replaced with a synthesized human voice module that could provide a verbal confirmation of the status of the various vehicle systems as their status is changed through the operation of device 1. Similarly, in the preferred embodiment, device 1 also includes a speaker 38 to announce system status commands within the vehicle. These commands may be by way of tones or synthesized speech.

Beeper 6 also contains an ultrasound receiver 37, and beeper control module 3 contains an ultrasound transmitter 34. Ultrasound transmitter 34 and ultrasound receiver 37 provide a means to automatically arm alarm means 16 when the operator leaves the vehicle. Ultrasound transmitter 34 continuously transmits an ultrasonic

pulse signal having a frequency of approximately 40 KHz. The range of this signal is limited to approximately 2 meters from the vehicle. When beeper 6 is brought within approximately 2 meters of the vehicle, ultrasound receiver 37 will receive ultrasonic transmissions from transmitter 34. However, when beeper 6 is moved beyond this approximate 2 meter range, ultrasonic receiver 37 fails to receive the ultrasonic signal generated by transmitter 34. When this ultrasonic signal is no longer received by receiver 34 a further radio frequency transmitter 29, also located within beeper 6, is activated. Transmitter 29 generates a first radio frequency signal, designated an "arm" signal, that is picked up by a radio frequency receiver 31 located in beeper control module 3. This signal is then sent from receiver 31 to microprocessor control 9, resulting in the arming of alarm means 16 and the locking of door locks 27. Accordingly, it will be appreciated that this structure will serve as a means to automatically arm alarm means 16 and lock the vehicle's doors when the operator leaves the vehicle and moves more than approximately 2 meters from it.

Similarly, when beeper 6 is brought within approximately 2 meters of the vehicle, ultrasonic receiver 37 will pick up the ultrasonic signal generated by transmitter 34, causing radio frequency transmitter 29 to send a second or "disarm" radio frequency signal to beeper control module 3. As a security feature this signal is specially coded to prevent anyone from scanning the command being sent. The second or "dis-arm" signal is captured by radio frequency receiver 31 and delivered to microprocessor

control 9, thereby resulting in the disarming of alarm means 16 and the unlocking of door locks 27. That is, beeper 6 will also serve as a means to automatically disarm alarm means 16 and unlock the vehicle's doors when an operator approaches to within approximately two meters of the vehicle. In the preferred embodiment a manual over-ride switch 44 is incorporated into beeper 6 to deactivate the ultrasonic control system.

As an alternate or additional means to help locate the position of a stolen vehicle, microprocessor control 9 can include an input jack 53 for connecting to a Global Positioning System (GPS) receiver 54 and a cellular telephone 55. GPS receiver 54 can be used to transmit a locating position signal to microprocessor control 9, which in turn can transmit that signal to the operator or to authorities via cellular telephone 55. In an alternate embodiment, GPS receiver 54 can be an integrated receiver built directly into main housing unit 2. Rather than using a complete cellular telephone 55, a cellular telephone transmitter, also integrated and built directly into main housing unit 2, could be utilized.

A further embodiment of the invention is particularly useful in the case of a car jacking. Once the vehicle has been started ultrasonic transmitter 34 continues to transmit an ultrasonic signal, however at an interval of one pulse approximately every two minutes. This will allow microprocessor control 9 to periodically verify the

presence of beeper 6. If the engine continues to run and beeper control module 3 does not receive a periodic second or "dis-arm" radio frequency signal from transmitter 29 (corresponding to the periodic transmission of the ultrasonic signal by ultrasonic transmitter 34) alarm means 16 will be activated. Alarm means 16 will also be activated in the event that the vehicle engine has been turned off and beeper control module 3 fails to receive the second radio frequency signal from transmitter 29 within two minutes, while the security system remains in the dis-arm mode.

While methods of arming and dis-arming alarm means 16 through the use of photo transmitter 5 and beeper 6 have been described, it should be noted that arming alarm means 16 through the use of a numerical pager signal will prevent disarming through use of either photo transmitter 5 or beeper 6. That is, when alarm means 16 is armed through receipt of a proper numerical pager code by microprocessor 9, the vehicle security system is placed in a "priority armed" mode that cannot be overridden by either photo transmitter 5 or beeper 6. If either the photo transmitter or beeper are stolen or lost, the operator will be able to arm alarm means 16 through a pager signal without fear of the lost or stolen devices later being used to gain unobstructed access to the vehicle. In addition, if alarm means 16 is activated remotely after the vehicle has been stolen, the thief will be unable to use either the photo transmitter or beeper to deactivate the alarm, or for that matter, to unlock locked doors.

It is to be understood that what has been described are the preferred embodiments of the invention and that it is possible to make variations to these embodiments while staying within the broad scope of the invention. Some of these variations have been discussed while others will be readily apparent to those skilled in the art. For example, while device 1 has been described for use in association with a vehicle having an internal combustion engine, it will be appreciated that such vehicles could include cars, trucks, heavy equipment machinery, airplanes and boats. It will also be appreciated that the internal combustion engine may be powered by gasoline, diesel or other forms of fuel.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device for remotely controlling the function of specified systems of a vehicle having an internal combustion engine, the device comprising:

(i) a microprocessor control for monitoring and controlling the function and operation of said specified systems of said vehicle;

(ii) receiving means to receive a plurality of remotely transmitted command signals;

(iii) decoding means to decode and authenticate said received signals and to thereafter deliver said decoded and authenticated signals to said microprocessor control;

(iv) a main housing unit for containing said microprocessor control, said receiving means and said decoding means; and,

(v) an integrated security system, said security system including alarm means, said alarm means armed and disarmed by said microprocessor control upon receipt of corresponding remotely transmitted command signals;

wherein said remotely transmitted command signals are numerical pager signals, said numerical pager signals transmitted by a paging transmission network and activated through the operation of a touch tone telephone hand set, said numerical pager signals received by said receiving means, decoded by said decoder means, and then directed to said microprocessor control to control the functioning of said specified systems of said vehicle.

2. A device as claimed in claim 1 wherein said specified systems of said vehicle include the vehicle's starter and ignition system, heating and cooling systems, and said integrated security system, said receiving means capable of receiving said remotely transmitted pager signals for purposes of starting said internal combustion engine of said vehicle, turning off said internal combustion engine of said vehicle, heating said vehicle, cooling said vehicle, and arming and disarming said integrated security system.

3. A device as claimed in claim 2 wherein said microprocessor control incudes timing means to operate said starter of said vehicle for a predetermined time interval.

4. A device as claimed in claim 3 including monitoring means to monitor whether said vehicle engine has been started.

5. A device as claimed in claim 4 wherein said monitoring means comprises means to monitor voltage fluctuations in electrical conductors connected to said internal combustion engine's alternator or tachometer.

6. A device as claimed in claim 4 wherein said monitoring means comprises means to detect the continuous transmission of electrical pulses through said internal combustion engine's ignition wires.

7. A device as claimed in claim 6 wherein said means to detect the continuous transmission of electrical pulses through said ignition wires comprises an electrically conductive wire wrapped around the circumference of one of said ignition wires to create an electrical coil about said ignition wire, said transmission of electrical pulses through said ignition wire inducing an electrical current in said electrical coil.

8. A device as claimed in claim 7 including means to detect and monitor said induced electrical current in said electrical coil to determine whether said vehicle engine has been started.

9. A device as claimed in claim 8 wherein said alarm means includes a siren and means to activate said vehicle's headlights and flashers when said alarm means has been activated.

10. A device as claimed in claim 9 including a hood sensor switch to deactivate said starter and ignition systems of said vehicle when said vehicle's hood has been opened.

11. A device as claimed in claim 10 wherein said microprocessor control includes means to control said vehicle's door locks.

12. A device as claimed in claim 11 including brake switching means to deactivate said starter and ignition systems of said vehicle when said internal combustion engine has been remotely started and said vehicle's brakes are applied.

13. A device as claimed in claim 12 including a parking brake switch and a vehicle transmission sensor wired to said microprocessor control, said parking brake switch and said transmission sensor preventing the remote starting of said internal combustion engine when said vehicle is equipped with a manual

transmission unless said transmission is in a neutral gear and said vehicle parking brake is applied.

14. A device as claimed in claim 13 including a speedometer monitor to monitor the speed of said vehicle, said microprocessor control allowing said vehicle's engine to be turned off upon the receipt of a corresponding command signal transmitted through said numerical pager network when said speedometer monitor indicates said vehicle is at rest.

15. A device as claimed in claim 14 wherein said remotely transmitted pager signals are digital signals.

16. A device as claimed in claim 15 wherein said vehicle is a car, truck, boat or airplane.

17. A device as claimed in claim 2 including external relay means, said external relay means deactivating said starter and ignition systems of said vehicle and said vehicle's fuel pump when said microprocessor control means has been disabled or has been removed from said vehicle.

18. A device as claimed in claim 17 wherein said external relay means is positioned in said vehicle remote from said main housing unit, said external relay means being operated by receipt of a relay controlling radio frequency signal transmitted from said main housing unit such that the operation of said external relay means can be governed by said microprocessor control without the use of wires directly connecting said external relay means to said main housing unit.

19. A device as claimed in claim 18 wherein said external relay means, when failing to receive said relay controlling radio frequency transmitted from said main housing unit, electrically isolating said fuel pump and said starter and ignition systems of said vehicle such that said internal combustion engine of said vehicle cannot be operated.

20. A device as claimed in claim 2 including a hand held remote photo transmitter, said remote photo transmitter operable to emit a coded sequence of infra-red light pulses that are receivable by a photo sensor connected to said microprocessor control thereby activating or deactivating said security system.

21. A device as claimed in claim 20 wherein said microprocessor control includes means to prevent the starting of said internal combustion engine when said alarm means has been either energized or activated.

22. A device as claimed in claim 21 further including a portable radio frequency signal transmitter, said portable radio frequency signal transmitter capable of transmitting a coded sequence of instructions to a radio frequency receiver connected to said microprocessor control, said coded instructions controlling said specified systems of said vehicle.

23. A device as claimed in claim 22 wherein said microprocessor control is programmable through the transmission of command codes from a programmer, said programmer operable to emit coded sequences of infra-red light pulses that are received by said photo sensor, said coded light pulses enabling for the remote programming of said microprocessor control.

24. A device as claimed in claim 23 wherein said microprocessor control is programmable through the use of a computer, said computer capable of interfacing with said microprocessor control.

25. A device as claimed in claim 2 including means to automatically arm said alarm means when the operator of said vehicle moves a pre-determined distance away from said vehicle.

26. A device as claimed in claim 25 including means to automatically disarm said alarm means when the operator of said vehicle moves within a pre-determined distance from said vehicle.

27. A device as claimed in claim 26 wherein said means to automatically arm and said means to automatically disarm said alarm means comprises an ultrasonic transmitter connected to said microprocessor control and an ultrasonic receiver contained within a beeper.

28. A device as claimed in claim 27 wherein said beeper is portable and capable of being carried by an operator of said vehicle, said ultrasonic transmitter having an effective range of approximately two meters and emitting an ultrasonic signal, when said ultrasonic receiver is moved beyond said effective range of approximately two meters and fails to receive said ultrasonic signal a radio frequency transmitter located in said beeper is activated causing the transmission of a first radio frequency signal that is captured by a radio frequency receiver located in said main housing unit and connected to said

microprocessor control, upon receipt of said first radio frequency signal said radio frequency receiver in said main housing unit causing said microprocessor control to automatically arm said alarm means.

29. A device as claimed in claim 28 wherein said radio frequency transmitter in said beeper, upon said ultrasonic receiver receiving said ultrasonic signal from said ultrasonic transmitter, transmitting a second radio frequency signal, said second radio frequency signal captured by said radio frequency receiver in said main housing unit and causing said microprocessor control to automatically disarm said alarm means.

30. A device as claimed in claim 29 wherein said microprocessor control automatically locks said vehicle's door locks when automatically arming said alarm means and automatically unlocks said vehicle's door locks when automatically disarming said alarm means.

31. A device as claimed in claim 30 wherein said beeper includes a radio frequency signal receiver, said radio frequency signal receiver in said beeper causing the generation of an audio tone by a tone generator in said beeper upon receipt of a radio frequency signal transmitted from said main housing unit in response to the activation of said alarm means.

32. A device as claimed in claim 31 wherein said microprocessor control also contains input jacks for connecting a Global Positioning System receiver and a cellular telephone to said microprocessor control, said Global Positioning System receiver providing a locating position signal to said microprocessor control, said microprocessor control transmitting said locating position signal, via said cellular telephone, to an operator of said vehicle, or to police authorities, upon receipt of a corresponding command signal transmitted through said numerical pager transmission network

33. A device as claimed in claim 32 wherein said radio frequency transmitter transmits signals of a frequency from about 27 MHz to 900 MHz.

34. A device as claimed in claim 33 wherein said ultrasonic transmitter transmits ultrasonic signals at a frequency of about 40 KHz.

ABSTRACT OF THE DISCLOSURE

A device, for remotely controlling the function of specified systems of a vehicle having an internal combustion engine, that comprises a microprocessor control for monitoring and controlling the function and operation of specified systems of the vehicle, receiving means to receive a plurality of remotely transmitted command signals, decoding means to decode and authenticate the received signals and to deliver decoded and authenticated signals to the microprocessor control, a main housing unit for containing the microprocessor control, the receiving means and the decoding means, and an integrated security system that includes alarm means that may be armed and disarmed by the microprocessor control upon receipt of corresponding remotely transmitted command signals. The remotely transmitted command signals are numerical pager signals transmitted through a touch tone telephone that has accessed a numerical paging network.

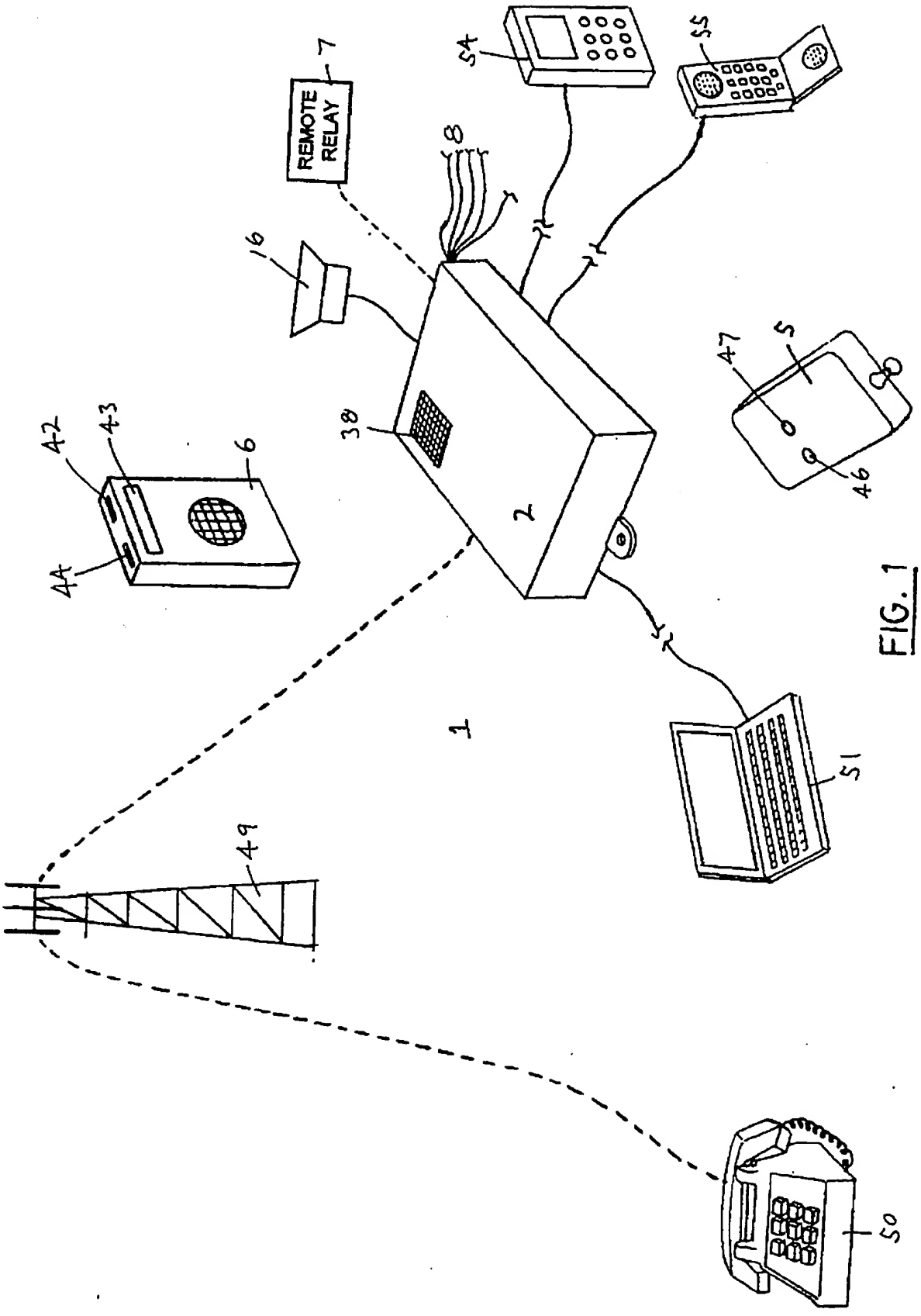

FIG. 1

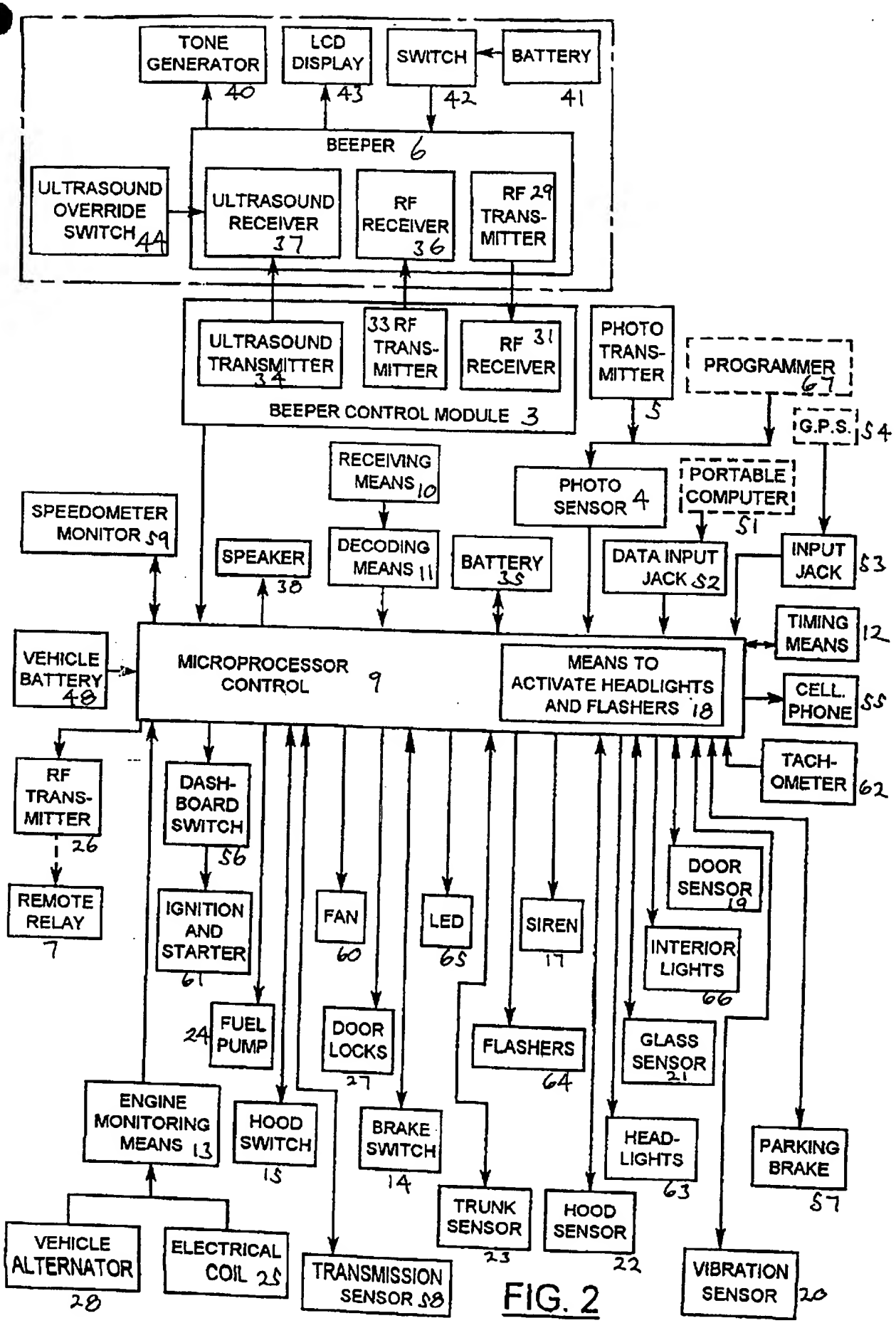
TONE GENERATOR 40
LCD DISPLAY 43
SWITCH 42
BATTERY 41
BEEPER 6
ULTRASOUND OVERRIDE SWITCH 44
ULTRASOUND RECEIVER 37
RF RECEIVER 36
RF 29 TRANS-MITTER
ULTRASOUND TRANSMITTER 34
33 RF TRANS-MITTER
RF 31 RECEIVER
BEEPER CONTROL MODULE 3
PHOTO TRANS-MITTER 5
PROGRAMMER 67
G.P.S. 54
RECEIVING MEANS 10
PHOTO SENSOR 4
PORTABLE COMPUTER 51
SPEEDOMETER MONITOR 59
SPEAKER 38
DECODING MEANS 11
BATTERY 35
DATA INPUT JACK 52
INPUT JACK 53
TIMING MEANS 12
VEHICLE BATTERY 48
MICROPROCESSOR CONTROL 9
MEANS TO ACTIVATE HEADLIGHTS AND FLASHERS 18
CELL. PHONE 55
TACH-OMETER 62
RF TRANS-MITTER 26
DASH-BOARD SWITCH 56
REMOTE RELAY 7
IGNITION AND STARTER 61
FAN 60
LED 65
SIREN 17
DOOR SENSOR 19
INTERIOR LIGHTS 66
24 FUEL PUMP
DOOR LOCKS 27
FLASHERS 64
GLASS SENSOR 21
ENGINE MONITORING MEANS 13
HOOD SWITCH 15
BRAKE SWITCH 14
HEAD-LIGHTS 63
PARKING BRAKE 57
TRUNK SENSOR 23
HOOD SENSOR 22
VEHICLE ALTERNATOR 28
ELECTRICAL COIL 25
TRANSMISSION SENSOR 58
VIBRATION SENSOR 20

FIG. 2